take these observations seriously, particularly as they necessitate the abandonment of every generally accepted belief with regard to mitosis. Surely Flemming, Boveri, Strasburger, and a hundred others were competent observers, and with regard to the fundamental facts connected with mitosis, and disputed by Mr. Ross, all are agreed!

The further descriptions of cell phenomena given in the present volume only serve to make clearer the obvious necessity of at least an elementary knowledge of a subject before undertaking original research therein. Various cytological terms are used in a manner which suggests that the authors are unfamiliar with the structures these terms were invented to specify. With regard to their statement that what they call Altmann's granules go to form the chromosomes, no better advice could be given than that they should study the already voluminous and rapidly growing literature relating to chondriosomes, to which the chief contributors are perhaps Benda, Meves, Duesberg, Prenant, Fauré-Frémiet, and G. Arnold.

(4) Mr. Green believes that "the lie of the ground seems to have a mysterious influence on the local incidence of cancer," and that this "can only be explained by its relation to the elimination and removal of products of coal combustion from the houses or from their neighbourhood." He claims, perfectly correctly, that houses built in hollows or on the sides of hills are most likely to suffer from smoky chimneys, and hence that people inhabiting such houses are most subject to the action of the products of coal combustion. He produces statistics and other evidence professing to show that cancer is most prevalent in towns situated in hollows and on steep or hilly sites. That various superficial forms, such as chimney sweep's and Kangri cancer, may be caused by some local irritant not unconnected with the combustion of coal or some other substance is probable, but it is difficult to connect internal cancers with coal. Again, Mr. Green's classification of towns is not altogether in accordance with fact. Glasgow has one of the lowest death-rates from cancer. Mr. Green places it among the towns occupying a flat site, as his theory, of course, demands. A considerable portion of Glasgow is probably as hilly as any town in the United Kingdom, and the hills are of that steep nature most likely to produce smoky chimneys. The Royal Cancer Hospital, itself in the middle of the town, is surrounded by inclines so steep that it is practically unapproachable by wheeled vehicles except in one direction.

C. E. W.

SCHOOL MATHEMATICS.

(1) *Geometry for Schools.* Vols. i.–iv. By W. G. Borchardt and the Rev. A. D. Perrott. (Cambridge Mathematical Series.) Pp. xiv + 325 + xiv. (London: G. Bell and Sons, Ltd., 1912.) Price 3*s.* 6*d.*

(2) *Algebra for Beginners.* By C. Godfrey, M.V.O., and A. W. Siddons. Pp. xi + 272. (Cambridge University Press, 1912.) Price 2*s.* 6*d.*

(3) *A School Algebra.* Parts ii and iii. By H. S. Hall. With answers. Pp. x + 301–550 + xxxix–lix. (London: Macmillan and Co., Ltd., 1912.) Price 2*s.* 6*d.*

(4) *Examples in Arithmetic.* Part ii. Taken from "A School Arithmetic." By H. S. Hall and F. H. Stevens. Pp. v + 117–281 + xxiii–xxxix. (London: Macmillan and Co., Ltd., 1912.) Price 2*s.*

(5) *The Calculus for Beginners.* By W. M. Baker. (Cambridge Mathematical Series.) Pp. viii + 166. (London: G. Bell and Sons, Ltd., 1912.) Price 3*s.*

OUR mathematical reformers are to-day fairly well agreed on the teaching of school mathematics; their opinions may be found in the various reports of the Mathematical Association and in the Report on the Geometry Syllabus by the American "National Committee of Fifteen." It is an interesting study to consider how far writers of text-books adopt these opinions, why they deviate from them, and what an author who holds these reforming opinions may do to advance them.

It is, for instance, remarkable with what unanimity the early introduction of solid geometry is recommended—only less remarkable than the rarity with which one finds that recommendation carried out. Messrs. Borchardt and Perrott (1) make a noble effort, and give, in the first six pages, a valuable little explanation of a number of three-dimensional terms; but the remainder of the 325 pages now before us appear to be restricted to two dimensions. And we have noticed a similar falling off in other authors. What is the explanation? The truth is that three-dimensional work is difficult and little suited to the capacity of the beginner. Little is possible at an early stage beyond the occasional discussion of a problem in which the data are in three dimensions, but the reasoning in reality two-dimensional.

The book on algebra by Messrs. Godfrey and Siddons (2) leaves us wondering. To avoid misapprehension, we say at once that it is a good book, undoubtedly good, for these authors could not write anything but good. But for the work

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of leaders of thought it is curiously old in form. They give rules for the treatment of signs on the removal of brackets, which we cannot imagine either of them using in actual teaching; we imagine them constantly carrying the boys back to the meaning of the expression under consideration, until the boys have absorbed the rule without ever putting it into words. And the quantity of manipulation: there are tons and tons, enough to wear down the teeth of the most omnivorous boy. All this manipulation cannot be intended for the boy of mathematical ability; he will acquire all necessary manipulative skill on a tenth of it. It cannot be intended for the non-specialist; he does not need such manipulative skill, and if he does acquire it he has no time left for the more human mathematical studies to which he ought to push on.

We are forced to conclude that the book is cast in this form to meet the demand of the market. We have no blame for suiting the book to the demand; on the contrary, we sympathise. Better to publish this book, which is the best on the market though weak in some ways, than an ideal book which no one would use. What we do suggest is that our leaders of thought should write books which meet the demand, and at the same time mark portions of the book for omission whenever circumstances allow it, in order to wean the teacher and examiner from useless studies.

In Mr. Hall's "School Algebra" (3) we find the same excess of manipulative exercises as in Godfrey and Siddons. On the other hand, we hail with delight his plan of using infinite series without proof of their validity. A clear consciousness of the concepts of mathematics is the first desideratum; abstruse proofs are for the few. A little more telescoping of the customary mathematical course and the non-specialist will be able in his school career to attain to the ideas of the calculus.

One desirable piece of telescoping is the omission from the compulsory course of permutations and combinations. They provide, of course, good mental gymnastic. As regards progress in knowledge, they lead up to the binomial theorem; so that they cease to be necessary in a course which assumes the validity of that theorem. At the same time, their discussion gives rise to many elegant theorems, and it is therefore well to leave them available for the leisure hour of the boy who fancies them.

Messrs. Hall and Stevens' "Examples in Arithmetic" (4) includes the treatment of stocks and shares. No doubt examination requirements necessitate their inclusion, but we should be glad to see their omission recommended for schools the circumstances of which allow it. The difficulties lie in the terminology and in the pupil's ignorance of the transactions involved; there are no arithmetical difficulties. Again, continued fractions, which at an earlier time provided the only means of obtaining approximations to complicated quantities such as surds, are now superseded by decimals, and might with advantage disappear from books on arithmetic.

The pruning away of unnecessary excrescences from the school course makes possible the inclusion of the infinitesimal calculus, which is more and more coming to be recognised as a regular school subject, and we welcome Mr. Baker's little book (5) as helping towards that desirable consummation. Mr. Baker no doubt caters for the boy who will need the calculus as part of his technical equipment in later life, and for that boy he rightly provides logical proofs of all theorems. In course of time the non-specialist boy will study the calculus in place of stocks and shares, permutations and combinations, and such things; and this boy should have a book on the lines suggested by Mr. Newbold in his little paper on "Higher Mathematics for the Classical Sixth Form," in which the ideas of the subject are evolved from the discussion of interesting everyday problems.

THEORETICAL AND APPLIED PHYSICS.

(1) *Heat and the Principles of Thermodynamics.* By Dr. Charles H. Draper. New and revised edition. Pp. xv+428. (London: Blackie and Son, Ltd., 1911.) Price 5*s.* net.

(2) *Laboratory Problems in Physics.* To accompany Crew and Jones's "Elements of Physics." By F. T. Jones and Prof. R. R. Tatnall. Pp. ix+81. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 2*s.* 6*d.*

(3) *Outlines of Applied Optics.* By P. G. Nutting. (Blakiston's Science Series.) Pp. ix+234. (Philadelphia: P. Blakiston's Son and Co., 1912.) Price 2 dollars net.

(4) *Elements of Hydrostatics.* With numerous examples. For the use of schools and colleges. By George W. Parker. Pp. viii+150. (London: Longmans, Green and Co., 1912.) Price 2*s.* 6*d.*

(5) *Junior Heat.* By Dr. John Satterly. Pp. viii+184. (London: W. B. Clive, University Tutorial Press, Ltd., 1912.) Price 2*s.*

(1) IT is refreshing to find, occasionally, an elementary text-book in which the author has been bold enough to depart from the stereotyped mode of treatment and introduce new features. Such is the case with the second edition of Dr. Draper's book. The author's intention, as expressed in the preface, of revising the book

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